In the Claims:

1. (Currently Amended) An apparatus for performing a manufacturing operation on a workpiece, the apparatus comprising:

a track assembly adapted to be attached to the workpiece, wherein the track assembly includes a pair of laterally opposed and longitudinally extending rails configured to flexibly conform to a contoured portion of the workpiece;

a carriage assembly moveably coupled to the track assembly and moveable relative to the workpiece; and

a position sensor operatively coupled to the carriage assembly and including a sensor element adapted to be operatively positioned relative to the workpiece, the sensor element being adapted to detect at least one edge of an index feature on the workpiece from a distance away from the index feature.

2. (Original) The apparatus of Claim 1, wherein the sensor element includes a fiber optic sensing element.

3. (Original) The apparatus of Claim 1, wherein the sensor element is adapted to detect the at least one edge of the index feature as the sensor element is being moved over the workpiece by the carriage assembly.

4. (Original) The apparatus of Claim 1, further comprising a controller operatively coupled to the position sensor, the controller being adapted to receive a first edge detection signal from the position sensor indicating that a first edge of the index feature has been detected along a first path of movement of the position sensor, and to receive a second edge detection signal from the position sensor indicating that a second edge of the index feature has been detected along the first path, and to compute a midpoint location based on the first and second edge detection signals.

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5. (Original) The apparatus of Claim 4, wherein the controller is further adapted to receive third and fourth edge detection signals from the position sensor indicating that third and fourth edges of the index feature have been detected along a second path of movement of the position sensor, respectively, and is also adapted to compute an estimated center of the index feature based on the first, second, third, and fourth edge detection signals.

6. (Original) The apparatus of Claim 1, further comprising a controller mounted on the carriage assembly and operatively coupled to the position sensor.

7. (Original) The apparatus of Claim 6, wherein the carriage assembly includes a drive assembly operable to translate the carriage assembly along the track assembly, the drive assembly being operatively coupled to the controller.

8. (Original) The apparatus of Claim 7, wherein the drive assembly is further operable to translate the position sensor in a direction that is transverse to the track assembly.

9. (Original) The apparatus of Claim 1, wherein the position sensor includes a sensing circuit having a first portion coupled to the sensing element, the first portion being adapted to receive an analog input signal and provide a conditioned analog output signal on a first output node, the sensing circuit further including a second portion coupled to the first portion and adapted to receive the conditioned analog output signal and to provide a digital output signal on a second output node.

10. (Original) The apparatus of Claim 9, wherein the first portion of the sensing circuit is adapted to provide a gain and level shift of the analog input signal.

11. (Original) The apparatus of Claim 9, wherein the second portion of the sensing circuit includes a threshold comparator circuit adapted to provide a first digital output signal when the

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conditioned analog output signal is below a threshold level, and to provide a second digital output signal when the conditioned analog output signal is above the threshold level.

12. (Original) The apparatus of Claim 9, wherein the first portion of the sensing circuit is adapted to provide a gain and level shift of the analog input signal, and wherein the second portion of the sensing circuit includes a threshold comparator circuit adapted to provide a first digital output signal when the conditioned analog output signal is below a threshold level, and to provide a second digital output signal when the conditioned analog output signal is above the threshold level, at least one of the gain and threshold level being programmable.

13. (Original) The apparatus of Claim 1, further comprising a tool assembly coupled to the carriage assembly and engageable with the workpiece to perform the manufacturing operation on the workpiece.

14. (Currently Amended) An apparatus for performing a manufacturing operation on a workpiece, the apparatus comprising:

a track assembly adapted to be attached to the workpiece, wherein the track assembly includes a pair of laterally opposed and longitudinally extending rails configured to flexibly conform to a contoured portion of the workpiece;

a carriage assembly moveably coupled to the track assembly and moveable relative to the workpiece; and

a position sensor operatively coupled to the carriage assembly and including a sensor element adapted to be operatively positioned relative to the workpiece, and a sensing circuit having a first portion coupled to the sensing element, the first portion being adapted to receive an analog input signal and provide a conditioned analog output signal on a first output node, the sensing circuit further including a second portion coupled to the first portion and adapted to receive the conditioned analog output signal and to provide a digital output signal on a second output node.

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15. (Original) The apparatus of Claim 14, wherein the first portion of the sensing circuit is adapted to provide a gain and level shift of the analog input signal.

16. (Original) The apparatus of Claim 14, wherein the second portion of the sensing circuit includes a threshold comparator circuit adapted to provide a first digital output signal when the conditioned analog output signal is below a threshold level, and to provide a second digital output signal when the conditioned analog output signal is above the threshold level.

17. (Original) The apparatus of Claim 14, wherein the first portion of the sensing circuit is adapted to provide a gain and level shift of the analog input signal, and wherein the second portion of the sensing circuit includes a threshold comparator circuit adapted to provide a first digital output signal when the conditioned analog output signal is below a threshold level, and to provide a second digital output signal when the conditioned analog output signal is above the threshold level, at least one of the gain and threshold level being programmable.

18. (Original) The apparatus of Claim 14, wherein the sensor element is adapted to detect at least one edge of an index feature on the workpiece from a distance away from the index feature.

19. (Original) The apparatus of Claim 14, wherein the sensor element includes a fiber optic sensing element.

20. (Original) The apparatus of Claim 14, wherein the sensor element is adapted to detect the at least one edge of the index feature as the sensor element is being moved over the workpiece by the carriage assembly.

21. (Original) The apparatus of Claim 14, further comprising a controller operatively coupled to the position sensor, the controller being adapted to receive a first edge detection signal from the position sensor indicating that a first edge of the index feature has been detected along a first path of movement of the position sensor, and to receive a second edge detection

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signal from the position sensor indicating that a second edge of the index feature has been detected along the first path, and to compute a midpoint location based on the first and second edge detection signals.

22. (Original) The apparatus of Claim 21, wherein the controller is further adapted to receive third and fourth edge detection signals from the position sensor indicating that third and fourth edges of the index feature have been detected along a second path of movement of the position sensor, respectively, and is also adapted to compute an estimated center of the index feature based on the first, second, third, and fourth edge detection signals.

23. (Original) The apparatus of Claim 14, further comprising a controller mounted on the carriage assembly and operatively coupled to the position sensor.

24. (Original) The apparatus of Claim 23, wherein the carriage assembly includes a drive assembly operable to translate the carriage assembly along the track assembly, the drive assembly being operatively coupled to the controller.

25. (Original) The apparatus of Claim 24, wherein the drive assembly is further operable to translate the position sensor in a direction that is transverse to the track assembly.

26. (Original) The apparatus of Claim 14, further comprising a tool assembly coupled to the carriage assembly and operatively coupled to the controller, the tool assembly being engageable with the workpiece to perform the manufacturing operation on the workpiece.

27. (Currently Amended) An apparatus for performing a manufacturing operation on a workpiece, the apparatus comprising:

a track assembly adapted to be attached to the workpiece, wherein the track assembly includes a pair of laterally opposed and longitudinally extending rails configured to flexibly conform to a contoured portion of the workpiece;

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a carriage assembly moveably coupled to the track assembly and including a drive assembly operable to translate the carriage assembly along the track assembly; and

a controller mounted on the carriage assembly and operatively coupled to the drive assembly, the controller being adapted to transmit control signals to the drive assembly to control movement of the carriage assembly over the workpiece.

28. (Original) The apparatus of Claim 27, wherein the controller includes a programmable CNC system operable to automatically transmit control signals to the drive assembly to automatically control movement of the carriage assembly over the workpiece.

29. (Original) The apparatus of Claim 27, further comprising a position sensor coupled to the carriage assembly and operatively coupled to the controller, the position sensor including a sensor element adapted to be operatively positioned relative to the workpiece, and a sensing circuit having a first portion coupled to the sensing element, the first portion being adapted to receive an analog input signal and provide a conditioned analog output signal on a first output node, the sensing circuit further including a second portion coupled to the first portion and adapted to receive the conditioned analog output signal and to provide a digital output signal on a second output node.

30. (Original) The apparatus of Claim 29, wherein the first portion of the sensing circuit is adapted to provide a gain and level shift of the analog input signal.

31. (Original) The apparatus of Claim 29, wherein the second portion of the sensing circuit includes a threshold comparator circuit adapted to provide a first digital output signal when the conditioned analog output signal is below a threshold level, and to provide a second digital output signal when the conditioned analog output signal is above the threshold level.

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32. (Original) The apparatus of Claim 29, wherein the first portion of the sensing circuit is adapted to provide a gain and level shift of the analog input signal, and wherein the second portion of the sensing circuit includes a threshold comparator circuit adapted to provide a first digital output signal when the conditioned analog output signal is below a threshold level, and to provide a second digital output signal when the conditioned analog output signal is above the threshold level, at least one of the gain and threshold level being programmable.

33. (Original) The apparatus of Claim 27, further comprising a position sensor coupled to the carriage assembly and operatively coupled to the controller, the position sensor including a sensor element adapted to detect at least one edge of an index feature on the workpiece from a distance away from the index feature.

34. (Original) The apparatus of Claim 33, wherein the controller is adapted to receive a first edge detection signal from the position sensor indicating that a first edge of the index feature has been detected along a first path of movement of the position sensor, and to receive a second edge detection signal from the position sensor indicating that a second edge of the index feature has been detected along the first path, and to compute a midpoint location based on the first and second edge detection signals.

35. (Original) The apparatus of Claim 34, wherein the controller is further adapted to receive third and fourth edge detection signals from the position sensor indicating that third and fourth edges of the index feature have been detected along a second path of movement of the position sensor, respectively, and is also adapted to compute an estimated center of the index feature based on the first, second, third, and fourth edge detection signals.

36. (Original) The apparatus of Claim 27, further comprising a tool assembly coupled to the carriage assembly and operatively coupled to the controller, the tool assembly being engageable with the workpiece to perform the manufacturing operation on the workpiece.

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37. (Original) The apparatus of Claim 36 wherein the carriage assembly is a first carriage assembly and the controller is a first controller, the apparatus further comprising:

a second carriage assembly moveably coupled to the track assembly and including a second drive assembly operable to translate the second carriage assembly along the track assembly;

a second controller mounted on the second carriage assembly and operatively coupled to the second drive assembly, the second controller being adapted to transmit control signals to the second drive assembly to control movement of the second carriage assembly over the workpiece; and

a position sensor coupled to the carriage assembly and operatively coupled to the second controller, the position sensor including a sensor element adapted to detect at least one edge of an index feature on the workpiece from a distance away from the index feature.

38. (Original) The apparatus of Claim 37, further comprising a master controller operatively coupled to the first and second controllers and adapted to transmit control signals to the first and second controllers, and adapted to receive feedback signals from the first and second controllers.

39. (Withdrawn) A method of performing a manufacturing operation on a workpiece, the method comprising:

supporting a manufacturing assembly proximate a surface of the workpiece, the manufacturing assembly including a sensing element that is operatively positioned relative to and spaced apart from the workpiece, the sensing element being moveable relative to the surface of the workpiece;

moving the sensing element along a first path on the workpiece; and

detecting at least one edge of an index feature on the workpiece from a distance away from the index feature.

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40. (Withdrawn) The method of Claim 39, wherein detecting at least one edge of an index feature on the workpiece from a distance away from the index feature includes detecting a reflected electromagnetic signal reflected from the index feature.

41. (Withdrawn) The method of Claim 39, wherein detecting at least one edge of an index feature on the workpiece from a distance away from the index feature occurs simultaneously with moving the sensing element along a first path that crosses an index feature on the workpiece.

42. (Withdrawn) The method of Claim 39, wherein detecting at least one edge of an index feature includes detecting first and second edges of the index feature along the first path, the method further comprising computing a midpoint location based on the first and second edges.

43. (Withdrawn) The method of Claim 42, further comprising detecting third and fourth edges of the index feature along a second path of movement of the position sensor, and computing an estimated center of the index feature based on the first, second, third, and fourth edges.

44. (Withdrawn) The method of Claim 39 wherein supporting a manufacturing assembly proximate a surface of the workpiece includes supporting a manufacturing assembly having a controller operatively coupled to the sensing element, and wherein moving the sensing element along a first path includes transmitting at least one control signal from the controller.

45. (Withdrawn) The method of Claim 39 wherein supporting a manufacturing assembly proximate a surface of the workpiece includes supporting a manufacturing assembly having a drive assembly operable to move the sensing element relative to the workpiece, and further having a controller mounted on the carriage assembly and operatively coupled to the drive assembly.

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46. (Withdrawn) The method of Claim 39, further comprising providing at least one output signal indicating a location of the at least one edge of the index feature.

47. (Withdrawn) The method of Claim 46, wherein providing at least one output signal includes providing an analog output signal.

48. (Withdrawn) The method of Claim 47, wherein providing an analog output signal includes applying a gain and level shift of an analog input signal to provide a conditioned analog output signal.

49. (Withdrawn) The method of Claim 48, wherein providing at least one output signal further includes providing a digital output signal.

50. (Withdrawn) The method of Claim 49, wherein providing a digital signal includes providing a first digital output signal when the conditioned analog output signal is below a threshold level, and providing a second digital output signal when the conditioned analog output signal is above the threshold level.

51. (Withdrawn) The method of Claim 39, wherein supporting a manufacturing assembly proximate a surface of the workpiece includes supporting a manufacturing assembly having a tool assembly engageable with the workpiece, the method further comprising operatively engaging the tool assembly with the workpiece.

52. (Withdrawn) A method of performing a manufacturing operation on a workpiece, the method comprising:

supporting a manufacturing assembly proximate a surface of the workpiece, the manufacturing assembly including a sensing element that is operatively positioned relative to and

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spaced apart from the workpiece, the sensing element being moveable relative to the surface of the workpiece;

moving the sensing element along a first path on the workpiece;

detecting at least one edge of an index feature on the workpiece;

providing a conditioned analog output signal indicating a location of the at least one edge of the index feature; and

providing a digital output signal indicating the location of the at least one edge of the index feature.

53. (Withdrawn) The method of Claim 52, wherein providing an analog output signal includes applying a gain and level shift of an analog input signal to provide the conditioned analog output signal.

54. (Withdrawn) The method of Claim 52, wherein providing a digital signal includes providing a first digital output signal when the conditioned analog output signal is below a threshold level, and providing a second digital output signal when the conditioned analog output signal is above the threshold level.

55. (Withdrawn) The method of Claim 52, wherein providing detecting at least one edge of an index feature on the workpiece includes detecting at least one edge of an index feature on the workpiece from a distance away from the index feature.

56. (Withdrawn) The method of Claim 55, wherein detecting at least one edge of an index feature on the workpiece from a distance away from the index feature occurs simultaneously with moving the sensing element along the first path.

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57. (Withdrawn) The method of Claim 55, wherein detecting at least one edge of an index feature on the workpiece from a distance away from the index feature includes detecting a reflected electromagnetic signal reflected from the index feature.

58. (Withdrawn) The method of Claim 52, wherein detecting at least one edge of an index feature includes detecting first and second edges of the index feature along the first path, the method further comprising computing a midpoint location based on the first and second edges.

59. (Withdrawn) The method of Claim 58, further comprising detecting third and fourth edges of the index feature along a second path of movement of the position sensor, and computing an estimated center of the index feature based on the first, second, third, and fourth edges.

60. (Withdrawn) The method of Claim 52, wherein supporting a manufacturing assembly proximate a surface of the workpiece includes supporting a manufacturing assembly having a controller operatively coupled to the sensing element, and wherein moving the sensing element along a first path includes transmitting at least one control signal from the controller.

61. (Withdrawn) The method of Claim 52, wherein supporting a manufacturing assembly proximate a surface of the workpiece includes supporting a manufacturing assembly having a drive assembly operable to move the sensing element relative to the workpiece, and further having a controller mounted on the carriage assembly and operatively coupled to the drive assembly.

62. (Withdrawn) The method of Claim 52, wherein supporting a manufacturing assembly proximate a surface of the workpiece includes supporting a manufacturing assembly having a tool assembly engageable with the workpiece, the method further comprising operatively engaging the tool assembly with the workpiece.

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63. (Withdrawn) A method of performing a manufacturing operation on a workpiece, the method comprising:

supporting a manufacturing assembly proximate a surface of the workpiece, the manufacturing assembly including a track assembly attached to the workpiece and a carriage assembly moveably coupled to the track assembly, the carriage assembly having a drive assembly operable to translate the carriage assembly along the track assembly, the manufacturing assembly further including a controller mounted on the carriage assembly and operatively coupled to the drive assembly; and

providing control signals from the controller to the drive assembly to drive the carriage assembly along the track assembly.

64. (Withdrawn) The method of Claim 63, wherein supporting a manufacturing assembly proximate a surface of the workpiece includes supporting a manufacturing assembly having a sensing element operatively positioned relative to and spaced apart from the workpiece.

65. (Withdrawn) The method of Claim 64, wherein the drive assembly is further adapted to move the sensor element relative to the carriage assembly.

66. (Withdrawn) The method of Claim 64, further comprising providing second control signals from the controller to the drive assembly to move the sensor element relative to the carriage assembly.

67. (Withdrawn) The method of Claim 64, further comprising detecting at least one edge of an index feature on the workpiece.

68. (Withdrawn) The method of Claim 67, wherein detecting at least one edge of an index feature on the workpiece includes detecting at least one edge of an index feature on the workpiece from a distance away from the index feature.

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69. (Withdrawn) The method of Claim 67, wherein detecting at least one edge of an index feature on the workpiece including moving the sensing element along a first path.

70. (Withdrawn) The method of Claim 67, wherein detecting at least one edge of an index feature on the workpiece includes detecting a reflected electromagnetic signal reflected from the index feature.

71. (Withdrawn) The method of Claim 67, wherein detecting at least one edge of an index feature includes detecting first and second edges of the index feature along a first path, the method further comprising computing a midpoint location based on the first and second edges.

72. (Withdrawn) The method of Claim 71, further comprising detecting third and fourth edges of the index feature along a second path, and computing an estimated center of the index feature based on the first, second, third, and fourth edges.

73. (Withdrawn) The method of Claim 67, wherein detecting at least one edge of an index feature includes

moving the sensing element along a first path on the workpiece;

detecting at least one edge of an index feature on the workpiece;

providing a conditioned analog output signal indicating a location of the at least one edge of the index feature; and

providing a digital output signal indicating the location of the at least one edge of the index feature.

74. (Withdrawn) The method of Claim 73, wherein providing an analog output signal includes applying a gain and level shift of an analog input signal to provide the conditioned analog output signal.

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75. (Withdrawn) The method of Claim 73, wherein providing a digital signal includes providing a first digital output signal when the conditioned analog output signal is below a threshold level, and providing a second digital output signal when the conditioned analog output signal is above the threshold level.

76. (Withdrawn) The method of Claim 63, wherein supporting a manufacturing assembly proximate a surface of the workpiece includes supporting a manufacturing assembly having a tool assembly engageable with the workpiece, the method further comprising operatively engaging the tool assembly with the workpiece.

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